Acquisition of an Amplified Ultrashort-Pulse Laser System for Ultrafast and Spectroscopic Studies of Condensed Matter Systems,

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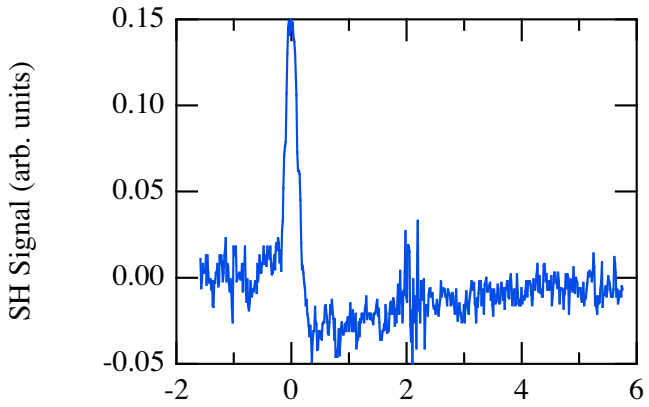
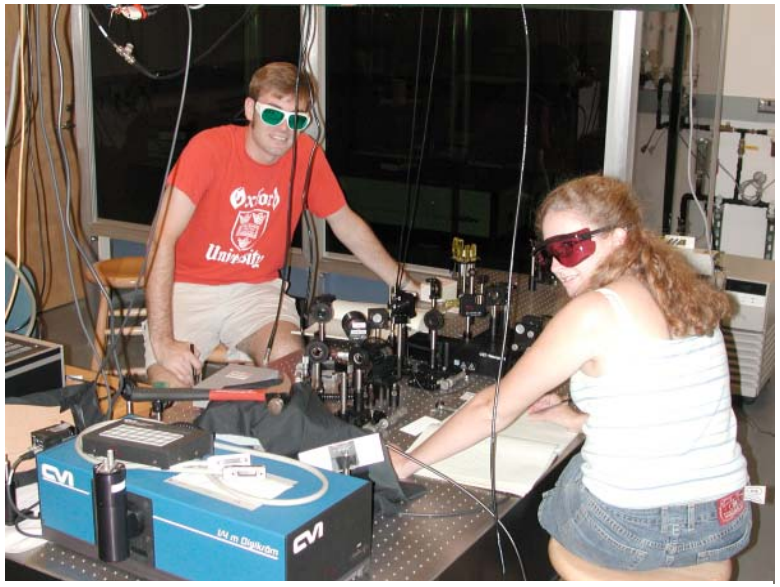
Status Report

In this first year of the grant we have:

- purchased a state-of-the-art short-pulse laser system
- had a laminar flow hood designed, built, and installed
- installed the laser system in T. Donnelly's laboratory
- characterized the spectral and temporal output of the system
- begun work with the laser on the study of second-harmonic generation in gold



Time-resolved pump-probe second-harmonic generation from a gold film. The large spike at zero delay shows the overlap of pump and probe pulses. After the pump has produced an excited electron distribution, second-harmonic generation is suppressed as the electron distribution relaxes and cools.



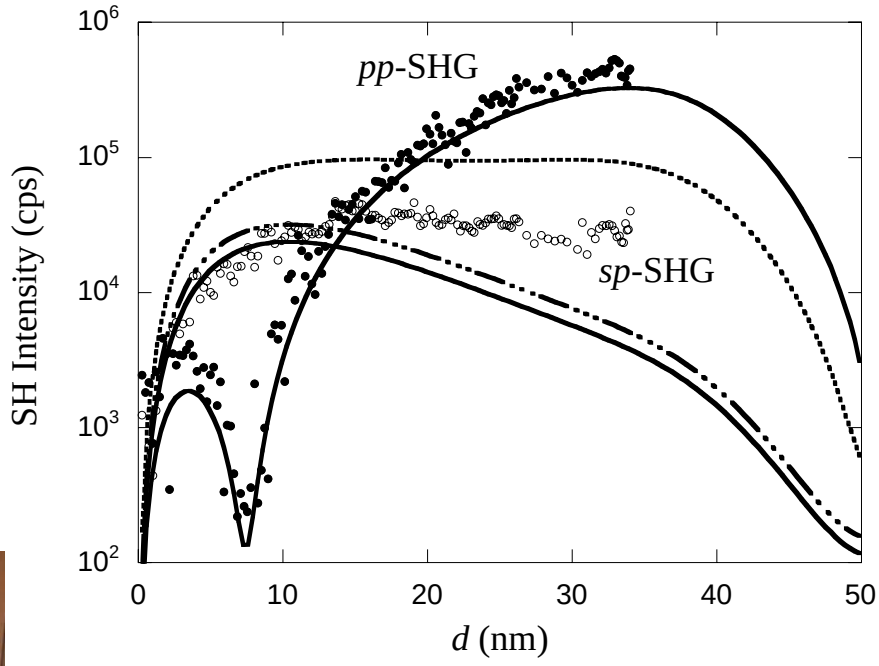
Students Laura Fisher and Andrew Grier taking data on gold second-harmonic generation.

- prepared delivery of a portion of the beam to P. Saeta's adjacent laboratory.
- prepared a detailed handout on lasers and eye safety, and required all persons who work on the system to have read and signed the safety handout.

Two students, Laura Fisher and Andrew Grier, worked with T. Donnelly over the summer and are continuing their work on the laser system during the current academic year, studying the time evolution of the excited electron distribution using pump-probe second-harmonic generation as the probe. A third student, Kyle Barbary, will be working on momentum dephasing in the gold system as well.

P. Saeta returned from sabbatical in Strasbourg, France, where he used a similar Spectra-Physics laser system in work on metal nanoparticles. Since returning, he has installed the beam tubes to permit the beam to pass safely through the wall that divides our two laboratories and to arrive on his optical table without risk to those working in the laboratory. Three students will be working with him on projects this semester using the new laser system to understand surface and bulk second-harmonic generation in silicon.

Beam tube bringing the laser beam from T Donnelly's adjacent laboratory into P. Saeta's lab, and onto the optical table, without "entering the room."



Second-harmonic generation from thin silicon layers as a function of layer thickness and under various polarization conditions. The pronounced dip in the *pp*-SHG near 8 nm silicon layer thickness remains puzzling. Using continuum generation, made possible with the much greater intensity of the new laser system, we will investigate the spectral dependence of this effect.